Subjective judgements in scientific practice and art

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ABSTRACT

Since art and science went their separate ways in the 18th century, the purpose of science has been to generate true knowledge based on reason and objectivity. However, during the second half of the 20th century, opinions emerged within science that showed the impossibility of eliminating subjectivity in scientific practice. This paper describes the similarity of the subjective judgements that form part of the peer-review system—the method devised by the scientific community to guarantee truth and objectivity—and the subjective judgements involved in artistic evaluation.

Until the 18th century, art and science in western culture walked in parallel and were not as clearly differentiated as they are now. There was no concept to distinguish art from other human activities, such as craft or science, and their products.[1] The frontiers were diffuse and the type of activity in this territory can not be clearly ascribed to a specific category of human knowledge or actions. Since antiquity, any activity related to art or science revolved around the platonic idea of 'the good, the true, and the beautiful'.[2 3] In the case of artists, their effort to attain objective truth reached its culmination in the early renaissance: 'First study science and then follow the practice born of that science', Leonardo da Vinci advised the artist.[2] Although, at the same time, Leonardo also began to question the platonic trinity by pointing out that any system of ideal proportions is in contradiction with the variety offered by nature. Artists and scientists saw that the simultaneous presence of truth and perfect beauty in representation was not possible, and the platonic ideal was abandoned in the late renaissance. This abandonment in science began in the early 17th century when Kepler rejected the theory that planets travel in circular trajectories, considered inevitable because they were the most perfect and harmonious, after observing that the planets follow elliptical orbits.

Subsequently, the arrival of modernity, with its clear rationalist vocation, led to the separation of art and science, culminating in the early 20th century when art and science definitively became opposing activities. Art was linked with intuition and subjectivity in the creation of aesthetic objects, in which the dissonant, the asymmetrical and the undefined gained the right to be beautiful. Science, for its part, became the producer of true knowledge based on the scientific method, reason and objectivity. Important discoveries like those of Galileo, Newton or Einstein supported the reliability of science as a source of knowledge, but the fundamental innovation was their configuration as institutions. Art was converted into a culturally different institution, in which a network of agents and entities—artists, critics, the public, national museums and libraries, galleries, collectors, industry, etc—interact with one another. Science saw the emergence of the scientific community, in which the different agents cooperate based on a series of norms of cognitive behaviour in order to increase the quality of knowledge. Subsequently, in the mid-20th century, the peer-review system emerged as the best way to ensure truth and objectivity, and scientific practice has now turned into something indistinguishable from peer review.[4]

CONSCIOUSNESS OF SUBJECTIVITY IN SCIENTIFIC PRACTICE

Curiously, from the time when science and art became separate disciplines, various post-modern philosophers such as Kuhn, Feyerabend and Latour began to voice their opinions denying the possibility that science could achieve true knowledge.[5] Likewise, during the second half of the 20th century, opinions emerged within science that showed the impossibility of eliminating subjectivity in scientific practice. It is assumed that authors, reviewers and editors resort to extra-scientific supports to defend their ideas. Empirical facts and reason are not the only supports for scientific hypotheses, because they are joined by other supports of a psychological, social or cultural character, in which speculations, feelings and status play an important role.[6–8] One need only pause to consider the debates on matters of scientific controversy to realise how fully subjectivity is incorporated into scientific practice. One of the intense debates about the possible effects of passive smoking on health serves as an example. The publication of a study in the *British Medical Journal* concluding that exposure to environmental tobacco smoke had no effect on mortality from ischaemic heart disease or lung cancer generated enormous polemic.[9] The journal published several letters to the editor, the authors' replies and two editorial comments.[10–12] In these comments, the editors noted the lack of arguments in many of the letters, and concluded that the debate was far more notable for its passion than for its precision.

Scientists are subject to the desires, biases, vanities, aesthetic tendencies and moral judgements that make up human nature and are influenced by prevailing ideas of what the world is like. Even though it is supposed that they must abandon them in the face of incontrovertible facts, this is not necessarily what happens. For example, aesthetic feelings can influence support for or rejection of a theory.[6] For many scientists, the beauty of a theory is an indication of its validity.[13]

Likewise, interpretation is never independent of a scientist's beliefs, preconceptions, or theoretical commitments. How scientists interpret what they see depends on what they expect.[8] It has been said that this may be the reason why only a few scientists make discoveries.[14] Furthermore, scientific interpretation often leads to interpretative biases.[15] This is the case of confirmation bias—evaluating evidence that supports one's preconceptions differently from evidence that challenges these convictions; rescue bias—discounting data by finding selective faults in the experiment; auxiliary hypothesis bias—introducing ad-hoc modifications to imply that an unanticipated finding would have been otherwise had the experimental conditions been different; or mechanism bias—being less sceptical when underlying science furnishes credibility for the data or when the data support the hypothesis that agrees with the cultural and intellectual climate of the period.

THE STRENGTH OF THE POWERFUL

At the beginning of the 1980s, Doris Lessing (1919), winner of the 2007 Nobel Prize for Literature and successful writer since the 1960s, submitted two books, under the pseudonym of the unknown Jane Somers, to various publishers who had published her previous books. The books were rejected. When they were published in the UK and the USA under the name of Jane Somers by two friendly publishing companies, they received few reviews in the press, and very few copies were sold. Doris Lessing stated that with this experiment she wanted to show the difficulty new writers encounter in publishing.[16]

In scientific practice, as well, reviewers and editors, rather than evaluating the merits of an author's work, not infrequently reflect in their assessments their feelings about the author's personal characteristics or social and professional position—ad hominen bias. Likewise, reviewers and editors often issue their judgements of a work based on the group or institution to which the author belongs—affiliational bias.[17] An experiment designed to investigate whether author gender affected reviewers' editorial decisions found that manuscripts authored by a woman were accepted in greater proportion by women reviewers than by male reviewers.[18] In another study, investigators sent to journals manuscripts that had been previously published by prestigious authors and institutions, but changing the names of the authors and institutions to others that were unknown. Very few editors or reviewers detected these as resubmissions, and most of the articles that were not detected were rejected.[19]

One of the first examples of these types of biases was the Matthew effect described by Merton.[20] The name of this bias comes from a verse from Saint Matthew the Evangelist: 'For whosoever hath, to him shall be given and he shall have more abundance; but whosoever hath not, from him shall be taken away even that he hath.' According to Merton,[20] when the same ideas or findings are conveyed independently by a highly reputed investigator and one who is unknown, it is far more likely that the peer-review system will accept the ideas and findings of the well-known investigator and will reject the ideas and findings of the less well-known one. The contribution to scientific knowledge would thus depend more on previous honours received than on the merit of the new work evaluated.

This situation is often damaging for young investigators because their talent may not be adequately recognised. For young people beginning their research career it is important to have a mentor at first, but as time passes it is advisable to differentiate their line of investigation from that of the mentor who, by virtue of seniority, will have more recognition.[21] Something similar occurs in art when the creations of young artists cannot be clearly and emphatically separated from the style of their mentors. An example is the artistic work of Camille Claudel (1864—1943), who is still eclipsed by the work of Auguste Rodin (1840—1917), her teacher and lover.[22] In her apprentice stage, Claudel collaborated on some of Rodin's brilliant works, and early in her career the work produced by student and teacher was very similar—Rodin's 'The Eternal Idol' is similar to Claudel's 'Sakountala' (figure 1) and 'The Kiss' of the teacher is close to 'L'abandon' of the student. It was not until her break with Rodin's style and themes that the most creative Claudel emerged and her best works were achieved. However, it has taken a long time for her talent as a sculptress to become recognised and for her extraordinary artistic personality to be valued over and above her relation with Rodin. Moreover, even today it is impossible to mention Claudel without citing Rodin.

THE SUCCESS OF PREVALENT IDEAS

The word 'kitsch' in the art world was popularised, among others, by Adorno in the 1930s.[23] Adorno used the term to refer to art that adapts itself to the needs of the market. One of the uses of this term is thus to designate the attitude of whoever desires to please at any price and to the largest possible degree. Kundera[24] asserted that to please one must confirm what everyone wants to hear, to be in the service of preconceived ideas. Likewise, the confirmation bias of editors and reviewers in scientific practice is well known, that is, the tendency to give more support to what confirms one's own convictions and to ignore or discredit what contradicts one's point of view.[17] This is why works that support prevalent theories have a high probability of being accepted.

In the field of social determinants of health, the thesis of Thomas McKeown (1912—88) is paradigmatic of this confirmation bias. This author devoted special attention to mortality from tuberculosis, attributing its reduction in England and Wales between the mid-19th century and the advent of streptomycin in 1947 to improved economic conditions.[25 26] In his opinion, the reduction in mortality from this disease would have continued even in the absence of therapeutic measures. The McKeown thesis was accepted as true by public health academicians and professionals throughout the last third of the 20th century, although his incorrect representation of the data minimised the impact of therapeutic measures (figure 2), and the vagueness of the concepts used made it impossible to confirm his hypothesis empirically.[27] Wilson[28] has recalled the extraordinary importance of medical treatment in the first half of the 20th century in reducing mortality from tuberculosis by creating tuberculosis sanatoria, and has noted that McKeown rejected it

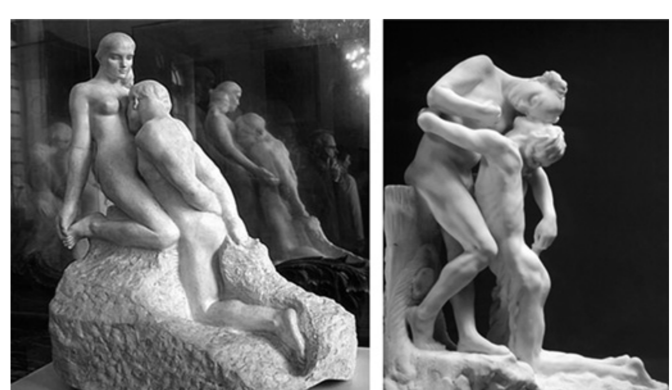
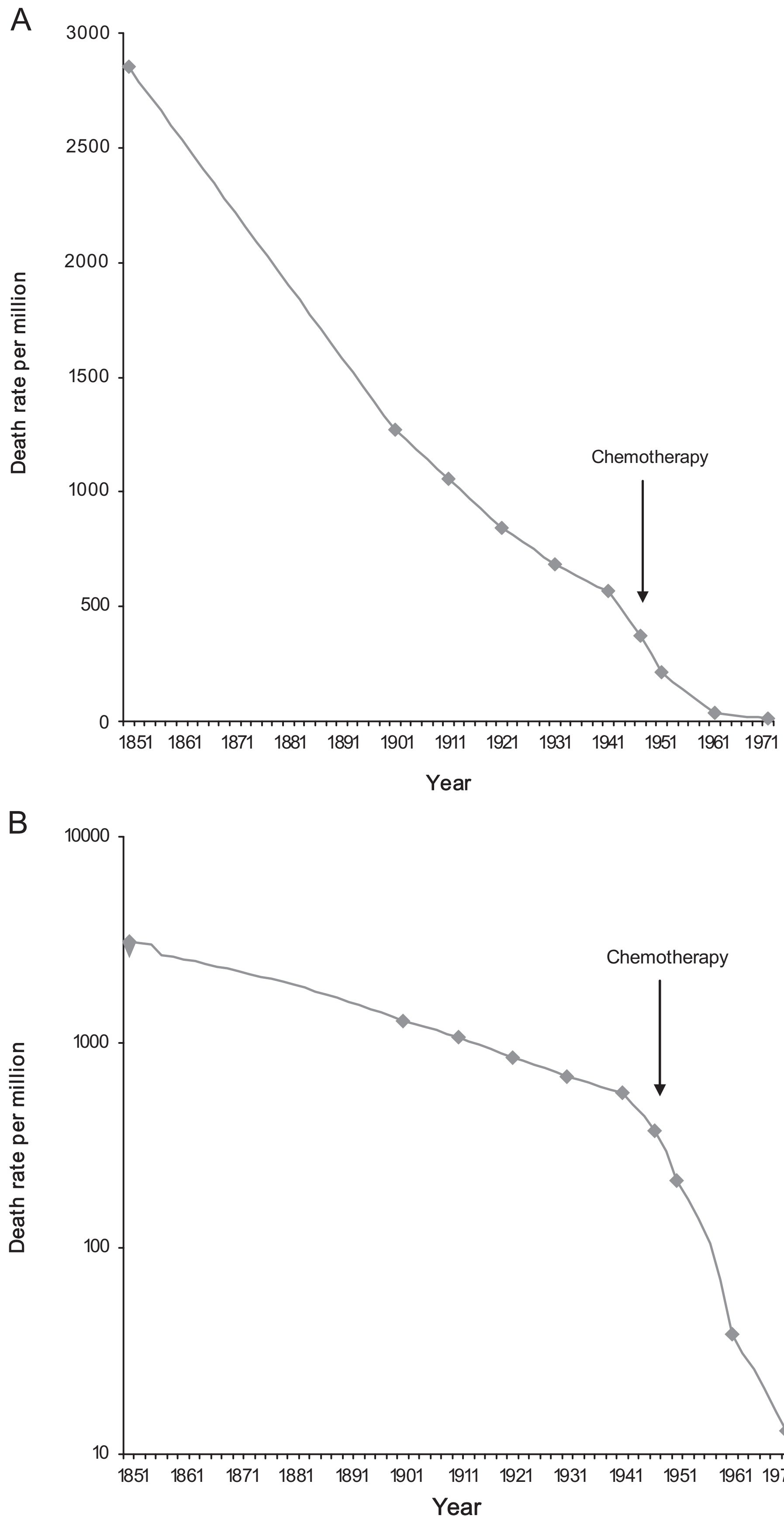


Figure 1 Rodin's 'The Eternal Idos' and Claudel's 'Sakountala'.

Figure 2 Evolution of the age-adjusted mortality rate for respiratory tuberculosis in England and Wales, 1851–1971. Note: McKeown was interested in representing the relative changes in the mortality rate from tuberculosis over time. He used the arithmetic scale (A) to represent the trend, but this scale is incorrect when the absolute magnitude of the phenomenon changes greatly over time. The correct approach would have been to use the semilogarithmic scale (B).



as ineffective without showing any evidence to support his opinion. For Wilson,[28] the disturbing question about McKeown is whether this author knew that what he was writing was nonsense. The response to this question must be sought in the generation of persons who dominated the field of public health in England between the 1950s and 1970s, for whom improvement in the material conditions of life and the distribution of wealth were basic elements in achieving better health. This generation carried the idea to an extreme, considering the assumption to be true for any health problem, in any circumstance, moment and place, even when evidence was lacking.[29]

THE FAILURE OF INNOVATION

This ideological bias of reviewers and editors in favour of prevalent viewpoints shows that work that is innovative or challenges prevailing opinion is highly unlikely to be published. This is easy to understand, considering that the investigators who occupy a position of power in the scientific community share accepted paradigms and thus are more likely to be reviewers, and editors, in turn, do not wish to see their journal's prestige plummet by publishing work that most of the scientific community considers to be speculative.[17] The Citation Classics feature of Current Contents was a collection of commentaries written by authors of frequently cited papers about the genesis of their research and the circumstances that affected its publication.[30] Logically, it is impossible to know of innovative works that have never been published; in contrast, based on the commentaries in Citation Classics, it is known that some papers previously rejected by several journals, once published have become widely cited in their respective fields of study.[31–33]

This epistemic conservatism in scientific practice has its correlate in the art world, where innovation and aesthetic experimentation are unwelcome. Porta[34] reminds us how the worlds of art and science look for excitement, flirt with danger, provoke believers, but at the same time both look to preserve their respectability because, in essence, art and science are conservative. The history of literature is full of examples of books initially rejected by the publishing industry but which, once published, became classics. In painting, the case of Gustav Klimt (1862–1918), who was commissioned to paint the ceiling of the Great Hall of the University of Vienna with symbolic representations of the faculties of philosophy, medicine and jurisprudence, is representative. The artist spent over 10 years on this work. However, when the paintings were displayed in the 14th Vienna Secessionist Exhibition between 1900 and 1905, they were the object of furious attacks by the press and the university staff, who called them pornographic. Faced with this scandal and protests, Klimt ended up removing the three paintings and giving up the commission.[35] The paintings were destroyed in World War II and can now be seen in the original size only in phototypes and lightboxes (figure 3).

Figure 3 Gustav Klimt, 'Medicine'. Oil on canvas, 430×300 cm.

CREATIVITY AS THE REMEDY

There is no foolproof way to propose scientific hypotheses that are likely to be true.[6] There are ways to facilitate scientific invention, like the systematic reordering of data, imaginary elimination of factors in order to discover relevant variables, or the search for patterns underlying seeming chaos. However, the generation of hypotheses responds to psychological patterns rather than logical ones, and to intangible aspects such as imagination or intuition. Only the scientist's creativity will make the innovation acceptable to the scientific community.[36]

Some authors consider that creativity is the combination of individual talent, which, using the rules and symbols of a specific discipline whether in art or in science, generates a new idea or produces something new and the acceptance of this contribution by the persons and institutions legitimised to evaluate whether or not it should be included within the discipline.[37] Creative scientists are not only able to defy the prevailing explanation of how things occur and propose an alternative explanation, but also possess an unwavering faith in their line of investigation even when it is not recognised. They also have an exquisite ability to use rational persuasion and other means to disseminate their findings in order to counteract the epistemic conservatism in scientific practice. Likewise, only the creativity of the artist will achieve acceptance of the innovation by critics, public, museums, national libraries, galleries, collectors, publishing companies, etc.

SCIENTIFIC PRACTICE AS A SCHOOL OF MODESTY

There is a fundamental difference between innovation in art and in science: Innovation in art is timeless, whereas in science it is transitory. In art, the creations of times past coexist with current creations, whereas creations in science are destined to oblivion. One has only to look at the small number of bibliographic references in scientific publications that are more than a few years old.

Scientific knowledge is mortal because it is knowledge that is essentially fallible. Knowledge in science is only an approximation of the truth, in the degree to which it corresponds to a stage of scientific development susceptible to being surpassed by scientific progress. The history of science shows how old theories once considered dogma were rejected as inadequate and were replaced by other new theories. Using the procedures of the scientific method, investigators raise questions and test hypotheses in such a way that these hypotheses can be verified or refuted by experience. The scientific community can repeat the experiment to check the interpretation of the investigator's findings and can criticise the hypotheses and test other alternative hypotheses. Popper[38] noted that there is no place for complacency or vanity in scientific practice. The scientific method allows us to learn, to increase our knowledge, but we can never know for sure; that is the essence of truth and objectivity in science.

What is already known on this subject

- Since art and science went their separate ways in the 18th century, the purpose of science has been to generate true knowledge based on reason and objectivity. However, subjectivity in scientific practice remains fully in force.
- The subjective judgements that form part of the peer-review system are similar to subjective judgements involved in artistic evaluation: the ad hominen bias, the affiliational bias and the ideological bias are present both in scientific practice and in art.

The scientific method does not avoid subjective judgements. Subjectivity will always accompany investigators, evaluators and editors because no one is free of prejudices. Subjectivity will always be present in the generation of scientific knowledge due to different perceptions of theory and facts, which inexorably leads to different interpretations. Only the future will tell what is the adequate interpretation.[8] However, if we have identified the AIDS virus, if we have developed drugs that improve diseases prognosis, if it is possible to fly in an aeroplane, this is because the scientific method, in the successive stages of scientific development, has managed to discover and unmask subjective judgements and to connect with reality; and it is this connection that ensures the objectivity of the knowledge generated.

ART/SCIENCE IS ALMOST ALWAYS A FAILURE

More than a century after art and science went their separate ways, the goal of eliminating subjective judgements in scientific practice is merely an illusion. The scientist, like the artist, can neither avoid nor control these judgements and does not know how his work will fare in the future. Moreover, success or failure sometimes depends only on chance. Some of the most important scientific discoveries in the history of science were produced by accident.[11] Horrobin[39] reminds us that the peer-review system in scientific communication is a 'non-validated charade whose processes generate results little better than does chance'. An example in art is the case of Italo Svevo (1861—1928), one of the masters of the European novel, whose work became known only fortuitously: 5 years before Svevo's death, he emerged from obscurity thanks to James Joyce's enthusiasm for his work after reading 'Zeno's Conscience'. Perhaps for these reasons, Porta[34] has taken the words of the painter Joan Miró (1893—1983) to affirm that scientists, like artists, must approach their work with the highest of ambitions, with maximum pride, to execute it with the greatest of humility, in the conviction that the territory of science, like that of art, is almost always a failure.

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